Nov. 10, 1925. 1,561,276

C. C. PANKRATZ

FLUID HEATER

Filed Jan. 13, 1925

Fig. 1.

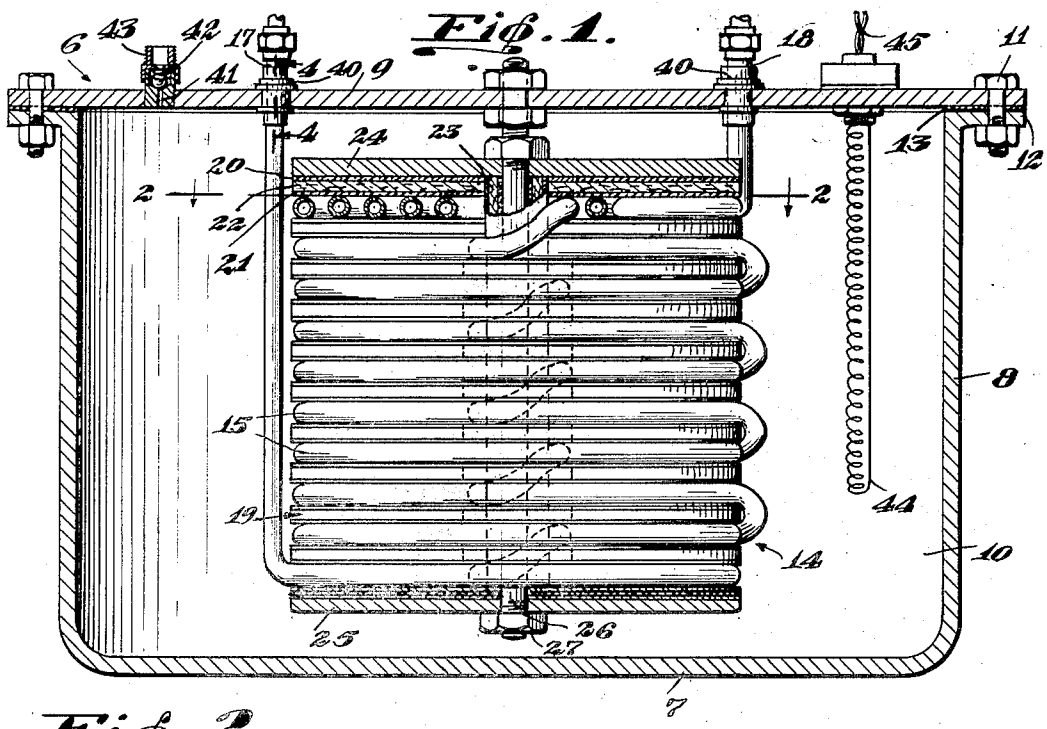


Fig. 2.

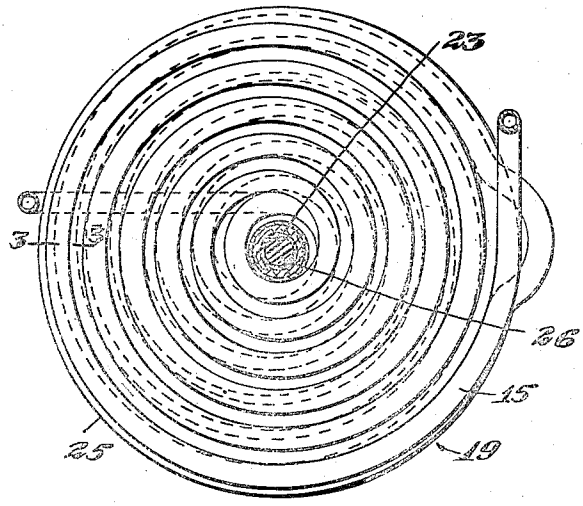


Fig. 3.

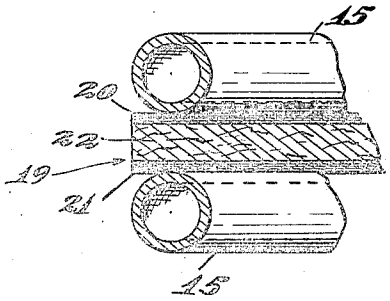
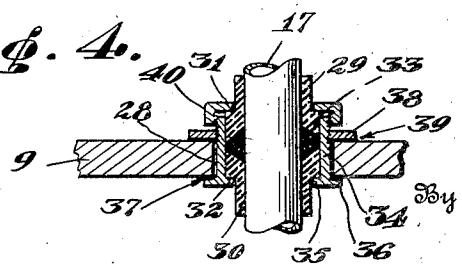


Fig. 4.



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UNITED STATES PATENT OFFICE.

CHARLEY C. PANKRATZ, OF ORANGE, CALIFORNIA.

FLUID HEATER.

Application filed January 13, 1925. Serial No. 2,140.

To all whom it may concern:

Be it known that I, CHARLEY C. PANKRATZ, a citizen of the United States, residing at Orange, in the county of Los Angeles and State of California, have invented new and useful Improvements in Fluid Heaters, of which the following is a specification.

This invention particularly pertains to an apparatus for heating fluids or vaporizing liquids by means of the electric current, and especially relates to a fluid heater of the type in which the fluid to be heated is passed through a conduit which constitutes an electrical conductor and resistance member and serves as a heating element.

An object of the invention is to provide an apparatus of the above character which is efficient and economical in its operation in that it minimizes loss of heat by radiation into the atmosphere.

Another object is to provide a construction and arrangement of the heating element whereby a large heating surface may be produced in a compact space, and to provide an assemblage whereby the heating element may be readily removed and replaced relatively to its mounting.

Another object is to provide a construction whereby the heating element may be readily mounted and inclosed within a hermetically sealed chamber, and to provide means whereby atmospheric gases may be evacuated from the sealed chamber so as to create and maintain a partial vacuum therein.

A further object is to provide an effective means for insulating the heating element from the walls of the chamber.

The invention will be best understood from a consideration of the following detailed description taken in connection with the accompanying drawings forming part of this specification with the understanding that the invention is not confined to any strict conformity with the showing of the drawings, but may be changed and modified so long as such changes and modifications mark no material departure from the salient features of the invention as expressed in the appended claims.

In the drawings:—

Figure 1 is a view of the fluid heater as seen in vertical section with a portion of the heating element shown in side elevation;

Figure 2 is a detail in plan as seen on line 2—2 of Figure 1;

Figure 3 is a detail in section as seen on line 3—3 of Figure 2;

Figure 4 is a detail in section as seen on line 4—4 of Figure 1.

More specifically, 6 indicates a housing having a bottom wall 7, side walls 8 and a top wall 9, enclosing a chamber 10. The top wall 9 is here shown as demountable, being secured by bolts 11 to a marginal flange 12 on the side walls 8.

The chamber 10 is designed to be hermetically sealed and to have atmospheric gases removed therefrom so as to create and maintain at least one inch vacuum therein. To minimize leaks the bottom wall 7 and side walls 8 are integral and imperforate, and a leak proof gasket 13 is interposed between the top wall 9 and the flange 12.

Arranged in the vacuum chamber 10 is a combined fluid conduit and electrical heating element 14 which comprises a length of metallic tubing which is of electrically conductive and resistant character so that it may be highly heated on passing the electrical current therethrough. In forming the element 14, the length of tubing is wound to form a plurality of layers 15 of coils which layers are preferably substantially flat with adjacent layers spaced apart in superimposed relation and connected together so that the several layers of coils may be formed of one piece of tubing.

In connecting the adjacent layers of coils the innermost convolution of one coil is formed in continuation of the innermost convolution of a contiguous coil and the outermost convolution of such united coils is formed in continuation of the outermost coils adjacent thereto. The bank or tier of coils thus formed is preferably of substantially cylindrical formation and of such diameter that when arranged in axial alignment with the center of the housing its circumferential portion will be spaced from the inner periphery of the housing side wall 10.

The convolutions of the end coils are turned to form substantially parallel intake and outlet terminal portions 17 and 18 which pass through and are insulated from the top wall 9 and have their ends connected to and insulated from fluid feed and discharge pipes (not shown) in any desired manner, and also are suitably connected to the conductors of a electrical conduit.

Interposed between each of the adjacent layers of coils is an insulating pad 19 which

preferably comprises spaced layers of mica 20—21 with a layer of asbestos fiber 22 therebetween, and extending axially of the series of layers of coils in an insulating tube 23.

The tier of layers of coils is arranged between end plates 24 and 25 which are insulated from the end layers by pads 19. The several layers of coils and pads are clamped between the end plates by means of a bolt 26 which is carried on the top wall 9 and extends through the end plates 24 and 25 and through the insulating tube 23 and is fitted with a nut 27 which is screwed on its outer end and is adapted to be tightened on the bolt to effect clamping of the layers of coils between the end plates.

The element 14 is thus carried on the end wall 9 and is rendered readily accessible on demounting the latter.

In order to insulate the tubing terminals from the wall 9 and also afford an air tight joint where the tubing passes through the wall the construction shown in Figure 4 is employed in which 28 indicates an opening in the wall 9 through which the tubing extends. Encircling the end portions of the tubing where it passes through the opening 28 is a pair of insulating sleeves 29 and 30 having annular shoulders 31 and 32 and between the ends of which sleeves is interposed a yieldable insulating material 33 adapted to serve as a packing and extending through the opening 28 is a metallic sleeve 34 one end of which is formed with inwardly and outwardly projecting flanges 35 and 36. The metallic sleeve encircles the insulating sleeves 29 and 30 with the flange 35 seating on the shoulders 32 and with the flange 36 bearing on a gasket 37 seating on the inner margin of the opening 28. A ring nut 38 is screwed on the outer portion of the sleeve 34 and bears on a gasket 39 seating on the outer margin of the opening 28 and screwed on the outer end of the sleeve 34 is an annular cap 40 which engages the shoulder 31 on the insulating sleeve 29; the cap 40 being adapted on being tightened on the sleeve 34 to force the insulating sleeve 29 toward the insulating sleeve 30 to press the packing material 33 tightly against the tubing.

The housing 6 is fitted with a vent 41 here shown as formed in the top wall 9 which vent is normally closed by a spring pressed valve 42; the vent being formed in a nipple 43 adapted to be connected to any suitable means whereby atmospheric gases may be drawn through the chamber 10 in initially creating vacuum therein. As a means for maintaining a vacuum in the chamber 10 or at least create a rarified atmosphere therein, in event of a leakage, a naked electrical conductor and resistance element 44 is arranged in the chamber 10 and connected to electrical conductors 45 whereby the element 44 on directing electrical current therethrough may be heated to incandescence to effect expansion of air within the chamber 10, whereby the pressure created by such expansion will effect opening of the valve 42 and cause a portion of the atmospheric gases to become exhausted from the chamber 10.

The heating element 44 may be controlled by any suitable switch mechanism not necessary to be here shown.

The operation of the invention is apparent from the foregoing it being seen that on directing electrical current through the tubing the latter will become heated so that on directing a fluid through the tubing such fluid will absorb heat therefrom and that by arranging the tubing within the vacuum chamber the loss of heat by radiation and through the walls of the housing will be minimized. The heater is particularly applicable for use in effecting the vaporizing of liquids such as water or oils, but may obviously be employed for heating or generating gas or vapors.

I claim:—

1. In a fluid heating apparatus, a vacuum chamber, and a fluid containing conduit arranged in said chamber having its terminals leading exteriorly of said chamber; said conduit constituting an electrical conductive and resistance element.

2. In a fluid heater, an enclosed chamber in which atmospheric pressure has been reduced and from which atmosphere is excluded, and a fluid containing conduit arranged in said chamber having its terminals leading to the exterior thereof; said conduit constituting an electrical conductive and resistance element.

3. In a fluid heater of the character described, a conduit for a fluid, a housing in which said conduit is arranged in a space of less than atmospheric pressure, said conduit constituting an electrical conductor and resistance element and having terminal portions extending through and insulated from the walls of said housing.

4. In a fluid heating apparatus, a plurality of layers of disk like coils of fluid conducting tubing connected in series one above another, said tubing being electrically conductive and resistant, an electrical insulating pad interposed between the adjacent layers of coils, and means for clamping said coils and pads firmly together.

5. In a fluid heating apparatus, a pair of spaced plates, a plurality of layers of flat coils of fluid conveying tubing arranged between said plates and connected in series, said tubing constituting an electrical conductive and resistant element, an insulating pad interposed between each of said layers and between the end plates and layers, and

means engaging said plates for clamping said layers of coils and the pads therebetween.

6. A fluid heater comprising a housing enclosing a hermetically sealed vacuum chamber, a coil of fluid conveying tubing arranged in said chamber, having its terminals extending through and insulated from the walls of said chamber, said coil being spaced from the walls of said chamber and constituting an electrical conductive and resistance element.

7. In a fluid heater of the character described, a hermetically sealed housing, an incandescent electrical heating element within said housing for effecting expansion of atmospheric gases therein, means for venting atmospheric gases from said housing, and a conduit for fluid arranged in said housing having its terminals extending through and insulated from the walls of said housing, said conduit constituting an electrical conductor and resistance element.

8. In a fluid heater of the character described, a hermetically sealed housing, an incandescent electrical heating element within said housing for effecting expansion of atmospheric gases therein, a valve for venting atmospheric gases from said housing, and a conduit for fluid arranged in said housing having its terminals extending through and insulated from the walls of said housing, said conduit constituting an electrical conductor and resistance element.

9. In a fluid heating apparatus, a plurality of layers of disk like coils of fluid conducting tubing connected in series one above another, said tubing being electrically conductive and resistant and adapted to be connected into an electrical circuit, a pair of end plates between which said layers of coils are arranged, insulating pads interposed between adjacent layers of coils and between the end coils in said end plates, a bolt connecting said end plates together, said bolt extending within the confines of said coils and insulated therefrom, and means screwed on said bolt whereby said end plates may be advanced toward each other to clamp said layers of coils and pads together.

CHARLEY C. PANKRATZ